



INFLUENCE OF THE SPATIAL ENVIRONMENT ON DESIGNING URBAN VEGETATIVE LANDSCAPES ON THE RIVERBANKS IN AL-KADHIMIYA CITY

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ABSTRACT

The urban uses of rivers have become common in cities, This has led to the emergence of diverse groups of open spaces along the riverbanks to interact with the river's environmental and natural system in various ways. However, the riverbanks in the city of Baghdad have not received sufficient attention for activating their riverbanks in terms of botanical design, given the scarcity of specialized local studies in this field. This study aimed to evaluate the riverbank in the Al-Kadhimiya area of Baghdad and conduct a comprehensive analysis of the site. This analysis includes examining the natural environment, functional analysis utilizing adjacent areas, vehicular and cultural values. The study aimed to understand the impact of these factors on the design of the urban vegetated landscape. Based on indicators identified from previous studies, indicators and values for each element were determined and applied to the current situation to assess the environmental context of the river edge in Al-Kadhimiya. The objective was to develop a theoretical framework that can be applied to the case study, allowing for the identification and addressing of shortcomings while recognizing and supporting strengths. The most important findings of The research is that using locally adapted plant species enhances environmental and cultural values while improving the functional and aesthetic values of the river edge. Additionally, selecting suitable plant species for specific locations increases visual openness, especially when integrated with perpendicular roads to the river edge and adjacent areas.

Keywords: Riverbank, Al-Kadhimiya, landscape, plant design.

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تأثير البيئة المكانية على تصميم المشهد الحضري النباتي لضفة النهر في مدينة الكاظمية

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الخلاصة

أصبحت الاستخدامات الحضرية للأشجار هي الشائعة في المدن وقد أدى هذا إلى ظهور مجاميع متنوعة من المساحات المفتوحة على ضفة النهر للتفاعل مع النظام البيئي والطبيعي للنهر بطرق مختلفة إلا أن الحافات النهرية في مدينة بغداد لم يكن لها اهتمام كافي لتفعيل حافتها النهرية من حيث التصميم النباتي وفي ظل ندرة الدراسات المحلية المتخصصة في هذا المجال هدفت هذه الدراسة إلى تقييم الحافة النهرية في منطقة الكاظمية في مدينة بغداد وأجراء التحليل الشامل للموقع والمتمثل في تحليل البيئة الطبيعية والتحليل الوظيفي لاستخدام المناطق المجاورة والنفوذ الحركي والبصري والقيم الثقافية ودراسة أثر هذه العوامل في تصميم المشهد الحضري النباتي وفقاً للمؤشرات المحددة من الدراسات السابقة. تم تحديد مؤشرات وقيم كل عنصر وتطبيقها على واقع الحال لتقييم البيئة المكانية الحافة النهرية في الكاظمية والخروج بإطار نظري يمكن تطبيقه على حالة الدراسة من أجل الوقوف على السلبيات ومعالجتها ومعرفة الإيجابيات ودعمها، ومن أهم النتائج التي توصل إليها البحث أن استخدام الأنواع النباتية المحلية المتكيفة مع البيئة يعزز من القيم البيئية والثقافية ويحسن القيم الوظيفية والجمالية للحافة النهرية وأن اختيار الأنواع النباتية في الأماكن المناسبة لها يعمل على زيادة الانفتاح البصري مع الطرق المؤدية إلى الحافة النهرية والمناطق المجاورة.

الكلمات المفتاحية: حافة النهر، الكاظمية، المشهد الطبيعي، التصميم النباتي.

INTRODUCTION

The open riverbank is an essential part of the urban fabric, giving it a distinctive character that sets it apart from other cities. Rivers have long been a primary factor in the formation of cities since ancient civilizations (Al-Ani, 2014). Its importance has increased over time due to the growing urban needs for the river and its riverbanks, including plants and other natural components (Shetawy, 2017). Highlighting the importance of the river and its riverbank from a tourism and recreational perspective, they contribute to boosting the local economy (Fenjan, 2022). They are part of the natural ecological components within the city where human intervention is minimal, thus serving as natural lungs for the city and providing it with many environmental and health benefits (Alkaisi, 2021). Studying riverfronts is an intriguing subject due to the plethora of rich phenomena, both material and cultural. They play a significant role in urban infrastructure as they serve as gathering places for people and are utilized for various purposes. Riverfronts are among the most attractive areas for users due to their natural recreational opportunities and diverse resources. A significant portion of urban success relies on the success of open spaces within cities, including riverfronts. (Al-Sharbini, 2009) Baghdad city has many advantages, the most important of which is its prominent location on the Tigris River, providing many riverbanks overlooking the river. These riverbanks form a strong link between the city and its surrounding natural elements, enhancing social and cultural connections among the city's residents. Consequently, the repair and development of these riverbanks benefit the community by providing green spaces for



recreation and relaxation, enhancing social interaction, improving air and environmental quality, and boosting tourism and local economy (Al-Hasani, 2012). The multiplicity of uses for the areas adjacent to riverbanks increases the importance and activity of these areas, thus the vegetative design will vary according to the requirements of use and adjacent areas. The presence of heritage buildings and symbolic elements gives a sense of belonging to the place, and plant species that contribute to highlighting these symbols should be used (Fenjan, 2022). It is essential to ensure a well-planned distribution of trees and shrubs along the riverbank to provide good visibility and visual connectivity from streets perpendicular to the riverbank and adjacent areas (Hussain & Jasim, 2019). The vegetative element plays a fundamental role in enhancing the aesthetic condition of the riverbank and serves multiple functions, including providing privacy for individuals and families by allocating dedicated spaces for this purpose (Al-Asadi, 2022). The relationships between open spaces are the cornerstone in organizing social interactions among individuals within these areas. Moreover, increasing vegetative diversity contributes to the proliferation of various living organisms and influences their behavior within the ecosystem (Jasim & Kamel, 2017; Sharbazhery, 2022). Furthermore, using various types of grasses with different growing seasons within the same area ensures the presence of green spaces throughout the year (Sabry & Abdal-latife, 2018). Trees and shrubs can fulfill additional functions besides their aesthetic roles. Utilizing deciduous trees and shrubs helps in obtaining sufficient sunlight during the cold seasons, especially in seating areas, while providing shade during hot seasons. Plants, in general, contribute to mitigating the extremes of weather conditions (Abdulateef & Al-Alwan, 2022; Fadhil & Waheeb, 2021). Additionally, it is often beneficial to use elements of Furniture in conjunction with the vegetative element, providing shade in sunny areas and other spaces for contemplation and reading. (Al-Fatlawi & Jasim, 2019; Al-Totanje & Jasim, 2023). When organizing interior spaces, it is important to take into consideration, pedestrian pathways, and bicycle lanes within the riverbank. Securing entry and exit points and ensuring the distribution of lighting elements in conjunction with the vegetative element to enhance aesthetics during nighttime are also important. All these factors contribute to achieving safety and increasing the usage hours of the riverbank during the night (Al-Sharbini, 2009). The aforementioned information indicates the scarcity of studies related to the design of the vegetative element for the riverbank in Baghdad, specifically in the Al-Kadhimiya area. It also highlights the study of the impact of the site's nature, adjacent uses, access roads, traffic axes, and social factors on the design of the vegetative landscape.

LITERATURE REVIEW

This paragraph includes a set of studies dealing with the activation of urban riverfronts. A group of vocabulary addressed by each study was identified. There are essential vocabulary that most or all studies focused on, given their importance and necessity in the process of activating spaces. The following is an explanation of each study.



The banks of rivers are considered public spaces that offer diverse patterns of social interaction. Therefore, development plans should enhance the natural and cultural aspects to ensure sustainable use of projects built on the riverbanks. The importance of public spaces lies in their value in the collective memory of the local community and visitors, as successful riverbanks provide opportunities for social interaction and connection with nature. This should consider the characteristics of the community and strive to strike a balance between the social, cultural, and natural environmental systems in the planning and implementation stages. (Shatawi, 2017). Furthermore, emphasis should be placed on the botanical aspect to enhance activities and functions linked to the riverbank, alongside the picturesque landscapes offered by plants. Riverfronts represent high-value spaces when integrated with city parts within a comprehensive ecological system. Spatial analysis of the site and social analysis of adjacent areas constitute the essence of the relationship between the community and the river. Riverfronts serve as an essential link in enhancing communication between nature and urban areas. Riverfronts require an integrated approach that avoids replicating designs from elsewhere while preserving the spirit and identity of the place. This approach encourages the creation of vibrant and attractive areas that focus on both the natural and cultural aspects. (Petrýlová & Matej, 2022). There are significant differences in the characteristics of riverbanks from one city to another and along the urban river stretch, with different patterns associated with each type of riverbank. It is important to consider preserving natural features, including plants and other living organisms, as well as preserving heritage and cultural features. Riverbanks can be wonderful places for recreational activities such as sitting under the shade of trees and enjoying nature, as well as other water sports. Therefore, it is necessary to provide the necessary infrastructure to support these activities in a sustainable and safe manner. (Vian *et al.*, 2021). There are several methods to activate urban spaces, with one of the most important being the activation of interior spaces. The study highlighted the significance of caring for greenery, particularly by planting trees without obstructing visibility. In addition, the research underscored the importance of organizing these spaces, taking care of internal movement pathways, and equipping them with suitable furniture in terms of design, resistance to diverse weather conditions, and ensuring smooth traffic flow to enhance accessibility (Riad, 2014). The design of riverbanks should be suitable for the natural and cultural context, with a well-thought-out plan that connects the site with its surrounding areas. This is achieved by providing spaces that connect people with nature through the development of main pedestrian axes that link to the riverbank. Additionally, the visual and environmental value is leveraged by creating areas for relaxation and engaging in water-related sports activities. Spaces for contemplation, reading, drawing, as well as areas for cultural and recreational events, such as gardens and green spaces featuring plant-based elements, are also incorporated. Artistic sculptures, fountains, and decorative elements are chosen to blend with the surrounding environment, with attention to lighting and merge it with the plant element to achieve safety (Jerke, 2008). The riverbank in the Al-Kadhimiya area of Baghdad faces problems related to its general design and the landscape in particular. The riverbank represents an irregular transitional space along the river, according to the location and distribution of

greenery. The overall space does not meet the needs of users and residents, and there are vast untapped potentials. Additionally, there is no regional vision for the riverbank. Therefore, it is necessary to refurbish it to achieve better utilization and sustainability, with a focus on the plant element to increase activities and functions associated with the riverbank. Furthermore, attention should be given to the scenic views provided by these plants. It was found that there is an uneven distribution of vegetation with the local environment and inappropriate uses for the nature of the place (Safaqis, 2015).

MATERIALS AND METHODS

The study adopted a descriptive analysis method for the indicators discussed in previous studies on riverbanks, aiming to establish a theoretical framework applicable to the case study in the Al-Kadhimiya site in Baghdad city, as illustrated in Table 2. The first column represents the indicators affecting the riverbank, while the second column represents the potential values for each indicator. The third column represents the estimation of these values, ranging from 1 to 3, where 1 indicates the lowest value, 2 indicates the moderate value, and 3 indicates the highest value. This estimation is used to identify strengths and weaknesses and to suggest appropriate recommendations.

Description of Al-Kadhimiya site

The Corniche Al-Kadhimiya, located in the city of Al-Kadhimiya, one of the districts of the capital, Baghdad. It is one of the oldest areas in the city and holds a significant religious importance. The area includes various recreational and commercial facilities, making it a comprehensive and integrated district.

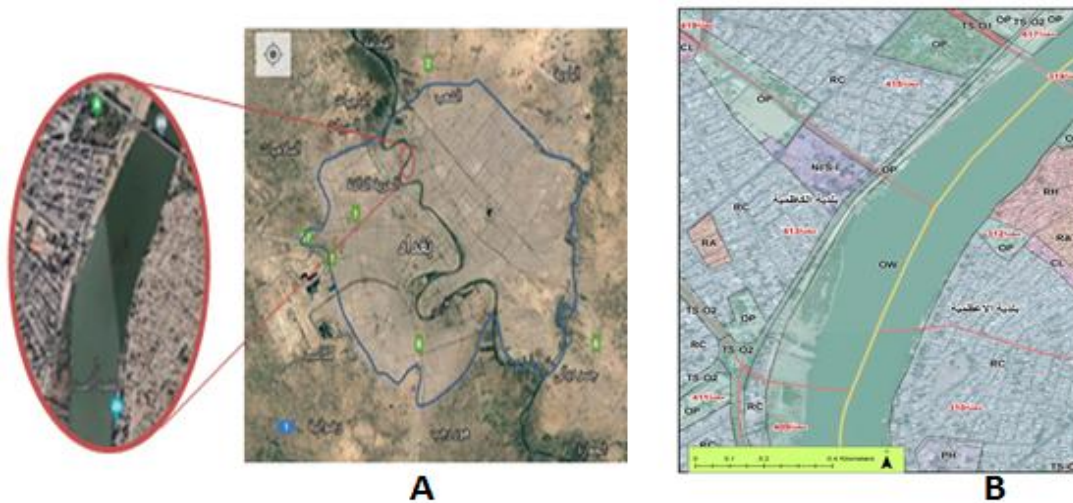


Figure (1-A): Explain the Al-Kadhimiya site in the city of Baghdad (1-B) Map showing the boundaries of the main and vertical roads Researcher, based on ArcGIS, 2020.

The functional and religious significance of the city cannot be ignored, as it is the reason for the development of urban activities, especially residential use. The location is bounded by the Imam Bridge to the north, the Tigris River to the east, residential areas in Al-Kadhimiya to the west, and it is bordered to the south by a square and the statue of the renowned poet Abdul Mohsin Al-Kadhimi. The shape of the site is that of a narrow strip connecting the river to the adjacent residential areas Figure (1). The Corniche is situated in the 413th neighborhood, with a length of 1300 meters and an average width of 20 meters, resulting in an area of 2000 square meters. The Corniche begins from the area adjacent to Imam's Bridge and extends to Abd al-Muhsin al-Kadhimi Square Figure (1-B). The Corniche takes the shape of a triangle, widening at its center and narrowing towards its ends. A slight curve is evident along the riverbank within the study area. The land is flat, and the riverbank has a steep elevation from the part close to the water to a higher area on the edge. There is an increase in the area of the zone adjacent to the water due to the river's recession in the areas far from the curved region. The site contains a few large trees such as *Zizyphus Spina* and *Phoenix dactylifera*, but lacks green spaces along the slightly winding riverbank Figure (2-B).



Figure (2 –A): The most important landmarks surrounding the site, Figure (2-B): some components the site, The researcher based on (Google, 2021).

There are some grassy areas like *Arundo donax* and *Imperata cylindrica* in regions adjacent to the water along the riverbank, contributing to the formation of habitats for various living organisms. The site has been paved with natural stone, and the gaps between the stones have been filled with cement. The covering of the riverbank has significantly isolated it from the river, depriving many natural habitats of their existence. The site suffers from a lack of

services and supplementary amenities for furnishing, such as sunshades for protection against sun rays and seating benches. This negatively affects both the environmental and sensory aspects. The riverbank avoids areas with residential use Figure (2-A), and the narrowness of the Corniche restricts the number of users, which is inadequate for the city's population density and the number of visitors to the city. There is a barrier in the form of an iron fence that separates the riverbank from the river, preventing users from accessing the river water and engaging in activities such as water trips, boating, sitting near the river, and fishing and interacting with natural components such as herbs and aquatic plants. Visual communication is direct in the Kadhimiya site and indirect in the streets perpendicular to it Table (2). Some large trees are present near the intersections of these perpendicular streets with the Corniche street, hindering visual communication. Currently, the site predominantly serves an entertainment purpose. One notable feature is the statue of the poet Abdul-Muhsin Al-Kadhimi within a square named after him Figure (2-A). The site is bordered along the riverbank by residential areas characterized by modern Western-style construction, which has led to the obscuring of the local and historical identity of the area.

Table (1): The similarities and differences between the case study and previous studies.

Studies	Summary of studies	Similarity to the study case	Difference from the study case
Petrtylová & Matej, 2022	Merging natural values within a comprehensive environmental system, making riverbanks a link between nature and urban areas, enhancing natural plant components to create vibrant living areas.	Variation in plant sizes	The botanical diversity: Variations in plant growth and flowering
Vian .et al 2021	Riverbanks offer diverse patterns of social interaction, providing successful opportunities for social engagement and a balance between natural and cultural systems	The presence of natural and synthetic components	Preserving the identity of the place and enhancing nature-related recreational activities
Shatawi, 2017	The use of authentic plant species, strengthening links between natural and individuals, preserving ecosystems, diversity of recreational activities .	Utilizing indigenous plant species.	Enhancing connections between nature and individuals, conserving ecosystems, and promoting a variety of recreational activities
Riad, 2014	The importance of reaching the river and the areas of gathering people, avoiding plants that hinder the vision continues, the components of nature and plants agree with other components	The scarcity of plants that obstruct visibility.	The significance of accessing rivers and communal gathering areas, the harmony of natural elements and plants with other surroundings
Jerke .2008	the focus on green spaces integrated with artistic symbols, fountains, sculptures, and heritage buildings. Special attention is also given to lighting, considering the botanical element and its interaction with ambient lighting.	The presence of artistic symbols and fountains. "	Developing movement paths, focusing on green spaces, and integrating lighting with botanical elements.

The presence of a sewage disposal location in the southern part of the site is a significant mistake, especially in areas like this, due to the environmental and health damages it may cause (**Aboud et al. 2015: Mahdi et al. 2018**) Figure (2-B) . The riverbank in the city of Kadhimiya faces challenges related to the maintenance of the river and the riverbank. This area represents an irregular transitional space along the river, varying according to location and the spread of buildings. There are only pedestrian paths leading to it, and the overall space does not meet the needs of users and residents. It was found that there are vast untapped potentials, coupled with a lack of a regional vision for the riverbank Figure (2-B), Therefore it is necessary to renovate it to achieve better utilization of the river, maintaining its effectiveness for long periods. It is essential to extract the factors influencing activities and their effects, evaluating the current situation of activities directly associated with the riverbank, both functionally and spatially. It was found that the distribution of activities is disproportionate to the local environment, With uses of adjacent areas that do not contribute to activating the riverbank edge, as well as the plant element design itself not supporting site activation.

Table (2): The most important indicators that influence the vegetative design of riverbanks which were discussed in the theoretical framework.

Design indicators	Possible values	Significance
The type of spaces adjacent to the riverbank	Narrow spaces	1
	Wide spaces	2
	Wide spaces with green cover	3
Integration with sculptural symbols and statues	The presence of vegetation element obscuring symbolic landmarks	1
	Dimensions of the plant element from the symbolic landmarks	2
	The presence of a vegetarian component that enhances the presence of symbolic landmarks	3
Space organization	neglected spaces	1
	Areas containing partial green spaces	2
	Areas containing integrated green spaces	3
Maintaining privacy	The existence of individual seating areas shaded by plant elements.	1
	The existence of areas designated for families, surrounded by vegetation	2
	. The presence of both script	3
Vision	The density of vegetation obstructs the view from perpendicular branches and nearby areas towards the river.	1
	. Vegetative density achieves a kind of visual continuity	2
	Optimal vegetative density allows for visual openness from perpendicular branches towards the river.	3
Plant diversity	Trees, shrubs, and green areas	1
	Trees, shrubs, green spaces, and hedge plants	2
	Flowering trees and shrubs year-round, along with green spaces and hedge plants	3



RESULTS AND DISCUSSION

The Efficiency and Effectiveness of the Riverbank in the Al-Kadhimiya Region in Baghdad City can be interpreted as follows.

Residential use predominates in the neighboring areas, except for the presence of a department affiliated with the Ministry of Water Resources in the southern part and a department affiliated with the Baghdad Police in the northern part of the site. Restricting the use to residential only could reduce the effectiveness of the riverbank since it is linked to individual privacy. There are no extensive green spaces between the river and residential areas, except 14 Tamuz Park for gardens in some residential buildings agree with (Petrtýlová, & Matej, 2022). The site is in the form of a narrow strip, not exceeding 20 meters at its maximum extent, making engineering design dominant and the sole system suitable for riverbank design. The plant diversity is limited to very few numbers of *Phoenix dactylifera*, *Zizyphus Spina* (lote tree) and cypress, with a scarcity of green spaces, which contributes to the difficulty of choosing an appropriate design. The security aspect is good, with attention to other safety measures. The street adjacent to the river is distinctive, providing visual continuity towards the river. However, the presence of perpendicular branches on the street parallel to the riverbank offers visual extension to the river, but they are few and do not extend to the city center. The movement paths within the narrow site are inadequate due to the construction of large-sized fountains and the limited availability of seating. The presence of large lote trees in areas where branches intersect with the street parallel to the riverbank hinders visual extension towards the river agree with (Riad, 2014). The lack of seasonal plants contributing to increased plant diversity and the absence of deciduous trees that could be used to provide shade in the summer and allow sunlight penetration in the winter have been noted. Additionally agree with (Shatawi, 2017). The scarcity of vegetation negatively impacts noise pollution and mitigates the severity of extreme weather conditions. The cliff area has been entirely paved with natural stone and the gaps between the stones have been filled with cement, resulting in complete isolation of the riverbank from the river water. This leads to depriving many living organisms of their natural habitats agree with (Riad, 2014). Despite the area having an ancient history, the adjacent buildings were constructed in a modern style after the removal of old structures, diminishing the significance of the area in terms of heritage and history. These buildings require botanical coordination that aligns with style of existing buildin agree with (Jerke, 2008; Mahdi & Jasim, 2023). There is only one symbolic statue in the area, dedicated to the poet Abdul-Muhsin Al-Kadhimi, and there are no water-related activities such as boating, swimming, or fishing. There is difficulty in accessing the site as there are no public transportation means that reach it, coupled with the absence of pedestrian pathways.

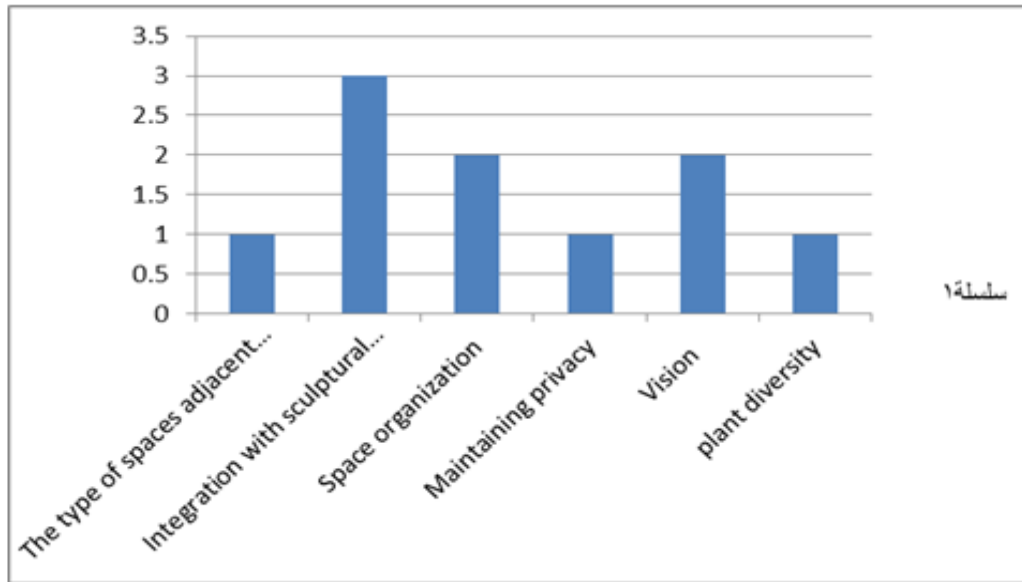


Figure (3): Represents the percentages of achievement of the studied elements for the Al-Kadhimiya site.

CONCLUSIONS

The scarcity of attractions especially the natural landscapes is likely to reduce the influx of visitors to the site. Residential use limits the effectiveness of the location, as it is associated with individual privacy, limiting accessibility and reducing the efficiency of the riverbank. The lack of wooded and diverse access routes also hinders an increase in the number of visitor. Lighting enhances the security and aesthetic aspects, Especially when combined with the plant element for allowing for additional hours of site usage, especially during the night. The presence of local grassy plants, such as reeds, in river sediment areas provides habitats for many living organisms, especially birds. There are no connecting areas between the two riverbanks except for the Imams' Bridge, rarely used by pedestrians. This hinders the connection between the riverbanks and reduces the efficiency and effectiveness of the riverbank. The existence of a sewage drainage area in the southern part of the riverbank contributes to increased environmental damage, in addition to unpleasant odors that are not suitable for riverbank development projects. The absence of heritage or historical buildings near the riverbank weakens the city's connection to its historical and cultural heritage And what it requires in terms of botanical design that aligns with those buildings. The narrow riverbank limits the creation of other activities that contribute to revitalizing the adjacent spaces or the riverbank itself.



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